

PREDICTIONS

**Hybrid
Composite
Electromagnetic**



DISCOVERIES

**Smart
Intelligent
Information**

Annual Report 1999

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UNIVERSITY OF KENTUCKY
COLLEGE OF ENGINEERING

**KENTUCKY
TRANSPORTATION
CENTER**

Message from the Director

Endings and beginnings serve as catalysts for pondering the past and anticipating the future. But this is the big one, ending with 1999 and beginning with 2000. At the Center, we're involved in transportation research, technology transfer, and education — and we are in an era of change.



Paul Toussaint

Our transportation network has changed how we relate to each other and how our economy works. Our communication capability (from telephone to e-mail) allows for dramatic shifts in how we think about distance (or don't even bother to think about it!), how we carry out commerce, and how we relate globally. Some say we're in an information technology age and some say it's the knowledge

age — whatever age, it represents a new dynamic economy with increasing demands. But when it comes to transportation, some things are hard to change because we have so much invested in the current infrastructure. However, I'm re-

minded of the third-world country that was able to dramatically improve communication by developing a simple tower network and providing one cell phone to each village. It didn't take thousands of miles of wire, hundreds of thousands of poles, and a decade to install with its system of switches. They leaped right over it.

In transportation we'll just plod along in some areas, but in others we'll make the leap. The future

will be exasperating (increased congestion) and exciting (smarter cars and highways). So where will we be able to make a leap or two — environmental sensitivity or sustainability, new composite materials, new fuels, life-cycle procurement, safety systems, simulator driver training, or a dedicated transportation trust fund? This millennial issue of our annual report lets you know where we've just been and gives you our ideas about where we might be going.

Our vision is to continue building a nationally recognized transportation center capable of delivering research, technology transfer, and education expertise and services aimed at addressing transportation needs throughout Kentucky and our region.

*Paul Toussaint is the
Director of the Kentucky
Transportation Center*

Our Mission

We provide services to the transportation community through research, technology transfer, and education.

We create and participate in partnerships to promote safe and effective transportation systems

We Value. . .

Teamwork — listening and communicating along with courtesy and respect for others.

Honest and ethical behavior.

Delivering the highest quality products and services.

Continuous improvement in all that we do.

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Organization*

Predictions for 2050

Within 10-15 years, the U.S. will ratify the 1997 Kyoto Protocol on global warming as a consequence of world opinion and pressure from trading partners. This will lead to a massive impact on transportation in the U.S. Look for a greater emphasis on mass transit and electric vehicles, especially in urban areas. There may be urban areas where one can't drive using vehicles powered by internal combustion engines by 2030. Look for nuclear power to make a comeback in the U.S. primarily due to transportation needs. By 2050, more U.S. vehicles will be powered by electricity (or some other source) than fossil fuels. By then, vehicles will not be controlled by humans in most areas of the U.S. — *Ted Hopwood, Environmental Analysis, KTC*

Computer hardware and software will advance to a level that makes it possible and feasible for a bridge designer to view holographic images of a design, and to walk through the image to inspect details prior to finalizing the design. Advances in high performance materials, new construction techniques and the introduction of robots in construction will permit designers to expand and introduce new highway structures. — *Issam Harik, Structures, KTC*

By the year 2050: All new drivers will complete 30 hours of driver training in a 'driving

simulator' experiencing problem situations and learning appropriate responses before hitting the road; Cars will be so smart and occupants so protected that it will be virtually impossible to have a fatal crash with another car; Every new roadway will provide substantial enhancements to the environment. Even environmentalists will want these benefits from a new roadway! — *Don Hartman, Programs Manager, KTC*

In the year 2050, new transportation projects will be the concern of, and available to, a broad range of the public. Information about the problem to be solved, the characteristics of the area concerned, and possible solutions will be available through interactive websites that educate the public and solicit input from them also. Instead of playing 3D video games as they now do, the citizens of tomorrow will do 3D "walkthroughs" of alternative designs that are customized to their preferences as to environmental sensitivity, access to work and home, sustainability, and efficiency—all on their online TV. Commercial vehicle operators (bus or truck) will have enhanced real-time routing information that allows them to provide driving services for goods moving in and through their local area while still being home each night. — *Ted Grossardt, Planning & Technology Solutions, KTC*

Message from the Transportation Secretary

We have the responsibility for delivering projects and managing the Commonwealth's transportation system for the benefit of all Kentuckians in a safe and sensitive manner. When we require assistance in developing new and innovative means and methods in accomplishing our objectives, applying new technologies, or meeting special professional development needs of our staff, we rely heavily on the Kentucky Transportation Center at the University of Kentucky.

The demands of the future will be a challenge for all of us.

We at the Cabinet expect the Center to continue helping us learn to be more sensitive to our environment as we design, construct, and maintain our transportation system. We also expect to continue to utilize the Center to assist us in utilizing the appropriate technology to move both automobile and truck traffic more efficiently and safer. We anticipate an expanded role for Intelligent Transportation Systems' (ITS) related activities to address our transportation problems in both urban and rural areas. As always, we will expect the Center to assist us in our efforts to



James C. Codell, III

address the numerous challenges that we encounter to enable us to address and uphold our responsibilities to the citizens of Kentucky.

The solutions will be the foundation for our transportation system, but we must be willing to think beyond traditional methods and vigorously move into the new century. We have enjoyed our working relationship/partnership with the Center in the past and believe that it will grow in importance as we work together to meet the transportation challenges of the future.

*James C. Codell, III is the
Secretary of the Kentucky
Transportation Cabinet*

Abbreviated History

- The Road Materials Testing Laboratory was established in 1914 at the University of Kentucky by Professor D. V. Terrell.
- In 1928, testing services were transferred to the Kentucky Department of Highways in Frankfort. Some research, however, continued at the University.
- The Kentucky Department of Highways moved its Division of Research to UK's campus in 1941 and operated the Division until 1980. The entire research program was transferred that year, contracting with UK to carry out the basic research program.
- On July 1, 1984, the Center was designated a Technology Transfer Center by the Federal Highway Administration (FHWA) to serve as a transportation extension service to Kentucky's local governments.
- The Kentucky Transportation Research Program and the Center's Technology Transfer Program operated as separate entities under the College of Engineering until 1988, when they merged to become the current Kentucky Transportation Center.
- The Advanced Transportation Institute (now called Transportation Systems Management Program), established at the Center in 1989, offers a post-baccalaureate certificate in transportation system management. The Center is a major participant in the consortium of University Transportation Centers in the southeast region.
- In February of 1999, a second location for the Planning and Technology Solutions Team was established at 343 Waller Avenue, Suite 300. This group was selected to serve as one of the six national training teams to deliver ITS/CVO courses to states on behalf of FHWA/OMC.



The Kentucky Transportation Center is located in the Oliver H. Raymond Building on the University of Kentucky campus.

Overview

Technology Transfer

- The Center serves as Kentucky's Local Technical Assistance Program (LTAP) providing services and technology linkage to local governments. Services are provided to state government employees, private industry employees, as well as others involved in transportation in Kentucky.
- Services include training programs, on-site assistance, a lending library (the only transportation library in the state), nontechnical publications, and newsletters.

Research

- The Center's comprehensive program of transportation research includes Environmental Analysis, Geotechnology, Intelligent Transportation Systems, Pavements, Policy and Impact Analysis, Structures, Traffic and Safety, and Planning & Technology Solutions.

- The benefits of research conducted through the years by the Cabinet and the Center have been significant. Information gained from the Center's research has affected transportation standards and methodologies, as well as provided solutions to difficult problems.

Experiential Education

- To provide students with real-world preparation, the Transportation Systems Management Program (formerly called Advanced Transportation Institute) offers a unique combination of academic study and hands-on application. The highly successful interdisciplinary approach draws students from areas such as civil engineering, geography, and business administration. Students completing the program are employed by a wide range of transportation related agencies and businesses.

REVIEW OF ACTIVITIES

The following pages present the Center's technology transfer, research, and experiential education activities during the fiscal year July 1, 1998, to June 30, 1999.

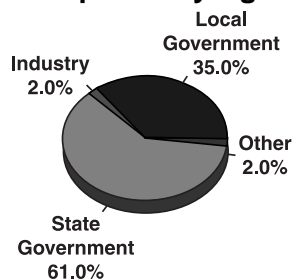
Technology Transfer (T²)

The Technology Transfer (T²) unit provides a direct, hands-on method for moving innovative transportation technologies out of the lab, off the shelf, and into the hands of the people who maintain our highways. Partnerships with the Federal Highway Administration (FHWA), the Kentucky Transportation Cabinet, and a national network of 57 technology transfer centers allow Kentucky Technology Transfer Program to present quickly and in a cost-effective manner practical solutions to real transportation problems. Innovative activities and creative execution are hallmarks of this customer-driven program that provides the following services:

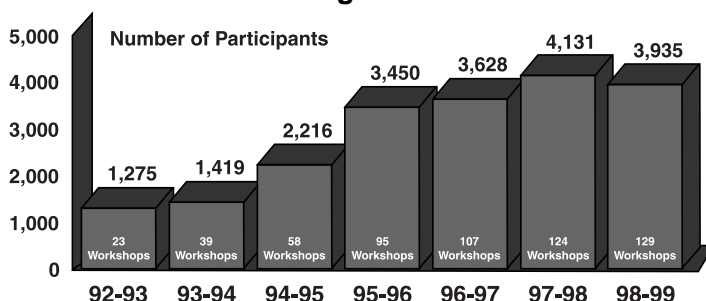
- Training for Kentucky's transportation workers
- Tried and true methods for maintaining highways
- Innovations and new information
- On-site technical assistance
- An information service featuring a state-of-the art library, the only transportation library in the Commonwealth
- Publications including newsletters, directories, manuals, and other non-technical publications
- A toll-free phone number (1-800-432-0719) for client use

The T² unit has been part of FHWA's nationwide LTAP (Local Technical Assistance Program) system since 1984. To deliver its services to Kentucky's transportation community, T² maintains an extensive mail list currently consisting of over 3600 transportation providers and users.

Participation by Agency



Training Courses



TRAINING

Attendance at the Center's 129 workshops/training sessions during this fiscal year was 3,935. Training was conducted in 80 locations across the state including four state parks and several vocational-technical schools.

Roads Scholar Training Program

The Roads Scholars Training Program offers basic operations training and introductory management training. Completion of nine courses provides local and state government employees with the designation of Roads Scholar, which is awarded at the yearly Transportation Forum. This year's 208 new Roads Scholars bring the total to 330 individuals who have earned this designation.

Road Master Training Program

An additional level of training, the Road Master Training Program, was introduced at this year's Transportation Forum, with 17 courses offered during this fiscal year. This training requires completion of seven additional courses for a Roads Scholar to become a Road Master. There are many individuals currently taking the classes with the first graduates expected in 1999.

Other Training and Activities

The one-day 34th Transportation Forum presented

"Protecting Kentucky's Environment" to almost 400 participants.

The 3rd annual Snow and Ice Conference was held in Lexington, with representation from five vendors and an attendance of 200.

On-demand training courses were presented at 17 agency locations throughout the state.

Special Training Programs for State and Industry

The following special courses were presented to 97 participants during the year:

Traffic Engineering Fundamentals

Stream Restoration and Soil Bioengineering

Train the Trainer for HMA/Superpave

Teleconference: Selection and Use of Consultants

Using the National ITS Architecture for Deployment

Bituminous Hot-Mix Asphalt and Superpave Training and Qualification Program

The Center, the Kentucky Transportation Cabinet, FHWA, and the Plant-Mix Asphalt Industry of Kentucky continue cooperative training to qualify individuals as Plant Technologists and Mix Design Technologists. The following courses were offered this year:

- Superpave Plant Technologist training was presented five times to the 109 new personnel and those technologists who need to requalify periodically.
- Superpave Mix Design Technologist course and/or exemption test was offered four times to 166 individuals.

The Transportation Hall of Fame Committee chose Harold C. Watts as the newest inductee into the Hall of Fame. Previous inductees include Henry T. Ward, Buckner Hinkle Sr., Cyrus Layson, Dwight H. Bray, C. M. "Hank" Hancock, Otto Ingram, and Calvin G. Grayson.

PUBLICATIONS AND MAILINGS

- Published a *Traffic Control in Work Zone Guidelines for High-Volume Facilities*.
- Published four editions of the Center's LTAP newsletter, *The Link*.
- Maintained T² Web Site (<http://www.engr.uky.edu/ktc>) including a training calendar that is regularly updated and published the twelfth edition of the *Kentucky Transportation Directory*.
- Developed and published a spiral-bound calendar/planner with the Center's training dates and other significant dates of interest to Kentucky's transportation community.
- Updated and published a Library video catalog.

Research Reports Published

Technology Transfer staff completed research and pub-

lished the results on the following projects:

- *A Report on County Road Program Finance* for Fiscal Year 1997-98 — A statistical summary of 118 of 120 Kentucky counties reporting on revenues received and payments made as related to their roadways.
- *Customer Satisfaction Survey Report* — This project continued the efforts begun in 1997 to monitor Kentucky public opinion regarding the quality of the highway system. The report also includes a portion to measure satisfaction with the current drivers' license and registration renewal processes.
- *Employee Satisfaction Survey Report* — Technology Transfer Unit staff completed this report for the Kentucky Transporta-

tion Cabinet to establish a baseline attitude of their employees.

LIBRARY

The Library provides information resources and services to state and local government employees; the Center's researchers and staff; UK faculty, staff, and students; and the general public. This year, attendance at the Library totaled 5,382 patrons. There were 1,534 materials circulated including 426 videos. Since videos are the most popular materials circulated, an updated video catalog was produced and distributed.

The Library added 938 volumes to its collection of over 18,000 materials.

The Library's Information Service provides answers

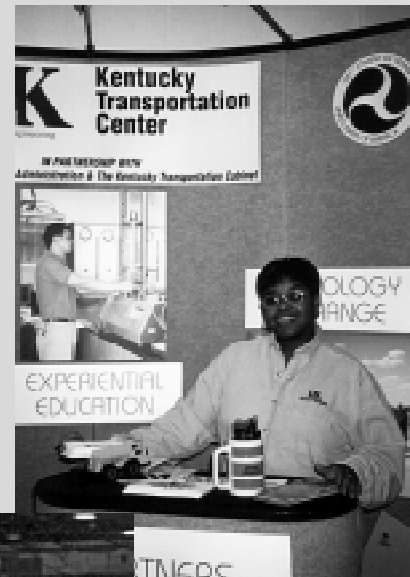
to inquiries ranging from pavement management to traffic safety issues, as well as questions on bridges, asphalt, concrete, and soils. Safety, including equipment and personal safety, is always an important and popular issue. This year, there were 668 questions answered.

KACERS

T² staff serves as secretariat for KACERS. There are currently 145 members with approximately one-third of Kentucky's counties represented. KACERS awarded free memberships to the 52 first-year Roads Scholars for this fiscal year. The Association meets four times each year, with its annual meeting held in conjunction with the Kentucky Association of Counties' (KACO) yearly convention.

The Technology Transfer unit exhibits at several Kentucky Association meetings each year to market our services. Nicole Worthy, training assistant, is ready to greet participants and tell them about the Center's training programs for local and state transportation employees.

This year's Snow and Ice Conference, held in Lexington, attracted representatives from five vendors and an attendance of 200.



Environmental Analysis

The primary function of the Environmental Analysis section is to conduct research on environmental issues of importance to the Kentucky Transportation Cabinet. Those issues include environmental information management systems, stream disturbance mitigation, environmental permitting and commitments, and public involvement in highway planning and construction. Other issues the section addresses include bridge coatings, a bridge maintenance and inspection working group, flexible highway design, and critical bridge component evaluation. The section partners with the Federal Highway Administration, the Infrastructure Technology Institute (ITI) at Northwestern University, the KTC Technology Transfer section, and industry to provide service to its' clients.

Environmental Analysis Research in Progress

Evaluation of Service Performance of Bridge Components

Approximately 350 bridges representing the three most common bridge types in Kentucky have been surveyed. Critical components were evaluated for performance and maintenance history.



Assessment and Modeling of Stream Mitigation Procedures

Five recently completed mitigation projects were evaluated for habitat and biological performance. KTC worked in cooperation with the University

School of Biological Sciences, Civil Engineering, and NREPC Division of Water.

Variations Between Design and Construction That Impact Environmental Commitments

During the planning and design phase of highway construction projects, environmental impact assessments often require permits and specific commitments to meet the requirements of those permits. Poor communication often results in delays to construction or violations of environmental permits. The planning-design-construction process as it relates to environmental commitments will be evaluated.



Reducing Public Opposition to Highway Construction

KyTC policies and practices that generate public opposition are evaluated for reasons and extent of opposition. This study will recommend procedures, guidelines, strategies, etc. to promote public support and develop a master plan for implementing those recommendations

Experimental Maintenance Painting on Various Bridge Projects

Developments in coatings technology are evaluated in the laboratory for ultraviolet, salt-fog, and freeze/thaw performance. Good performing coatings are applied in field experiments.

Experimental Maintenance Painting on the I-65 Kennedy Bridge

Experimental coatings and surface preparation techniques are evaluated on the I-65 Kennedy Bridge overcoating project.



A Regional State Highway Agency Working Group to Advance Bridge Maintenance and Inspection Practices

Five area state highway agencies have formed a working group to share cost and technical information in an effort to improve operational practices for bridge maintenance and inspection. The research agencies associated with those states have been an integral part of the working group.

Projects with Section Participation are:

- Flexibility in Highway Design
- FHWA Grant: Integrated Model for Transportation Planning and Context-Sensitive Design

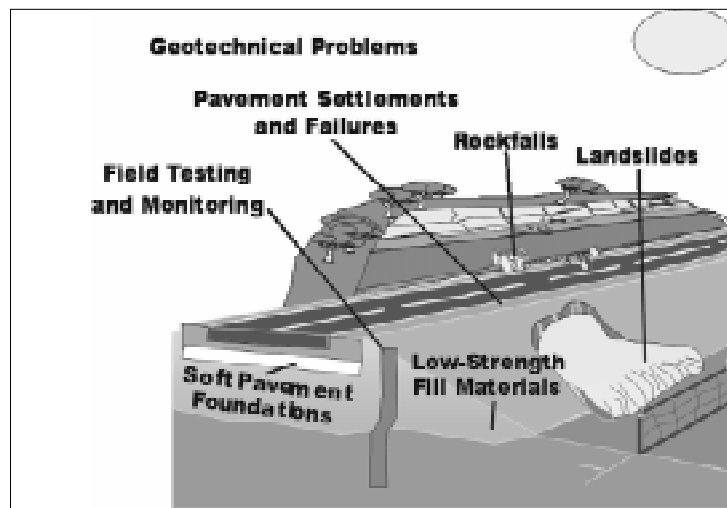
Environmental Research in the New Millennium

Environmental issues of particular significance to state highway agencies in the new millenium will include; air quality, public involvement, community impact assessment, environmental justice, and esthetics.

Geotechnology

The Geotechnology section conducts research on soil and rock materials used in the construction and maintenance of transportation facilities. Finding new and innovative ways of improving materials with marginal engineering properties, developing new techniques for preventing and repairing landslides and rock falls, improving highway design standards, and developing new mathematical techniques for designing geotechnical structures have been major focuses of the sec-

tion. The section has two well-equipped, accredited geotechnical laboratories for testing soils, rocks, and aggregates and two truck-mounted drill rigs for in situ testing, rock coring, cone penetrometer, and soil sampling. Implementation of past research performed by the section has created new ways of building highways in Kentucky and saved millions of dollars. Because some 50 to 90 percent of the total cost of building new highways involves excavating and placing



Some typical geotechnical problems.

soils and rocks, investments in geotechnical research offers great opportunities for reduc-

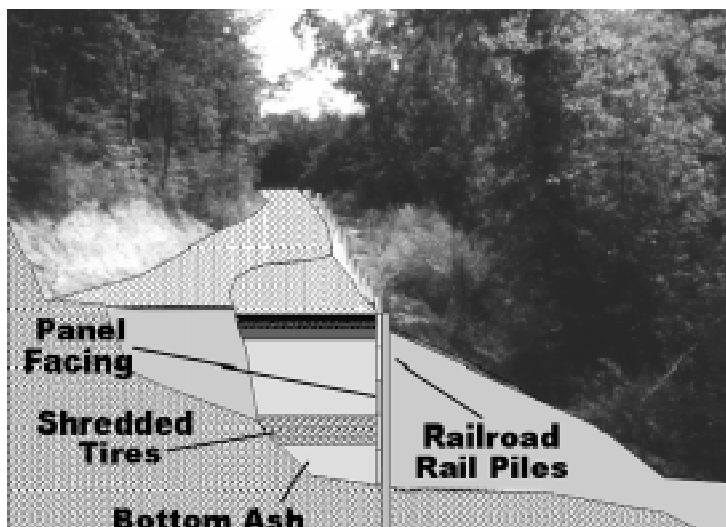
ing the cost of building and increasing the quality of Kentucky highways.

Geotechnical Research in Progress

Development of a State-wide Landslide Inventory Program — more than 1500 highway landslides on Kentucky's highways have been catalogued and rated. More are being identified. These data will be used to manage landslide problems in Kentucky in coming years.



Examination of Economic Methods for Repairing Highway Landslides - One innovative repair method uses lightweight materials (shredded tires, bottom ash from coal-fired power plants, geofoam - same material used to make coffee cups — “red dog,” or expanded shale aggregate) as backfill behind used railroad steel rails.



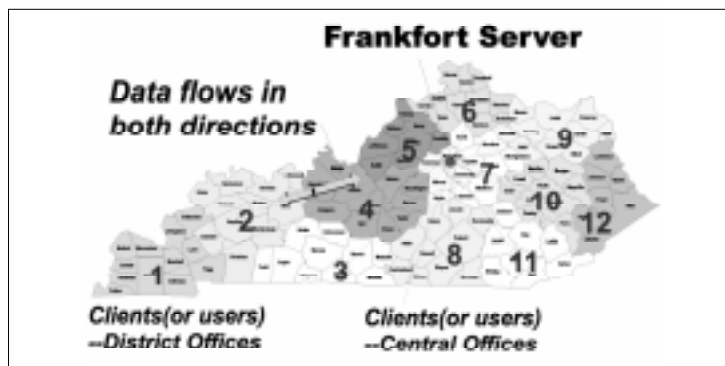
Highway Rock Slope Risk Management System - more than 10,000 rock cut slopes on Kentucky's highways have been examined. Some 1650 of those slopes have been rated numerically for potential rockfall and located by geographical positioning satellite (GPS) equipment. Additional sites are being located. These data will be used to manage rockfall problems in Kentucky in coming years.

Geotechnology

continued from previous page

Benefits of Stabilizing Highway Pavement Subgrades -

Adding small percentages of cement or hydrated lime to Kentucky's weak soils produces an increase in strength ranging from twenty fold to hundredfold, as shown by data from sites as old as 14 years. Performances of pavements constructed on chemically stabilized subgrades have been excellent.

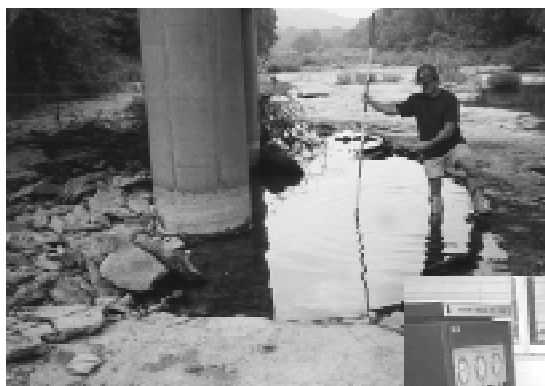


Rockfall and Landslide Databases – Database methodology for landslide and rockfall sites have been built and reside on a Frankfort computer server. Data, including photographs, are stored in a client/server environment for instant retrieval. Highway District Offices and selected Central Offices of the Kentucky Transportation Cabinet are being connected to the databases. When in place, the Kentucky Transportation Cabinet will have a very effective means of managing highway landslide and rockfall problems.

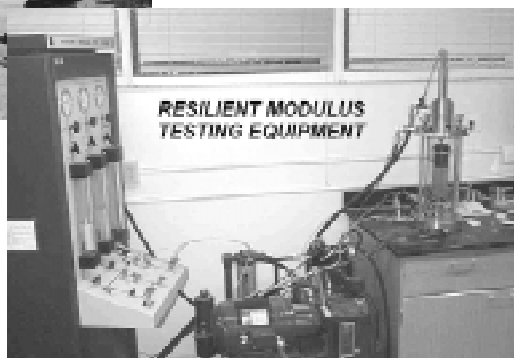
Recently Completed Geotechnical Research:

Scour of Bedrock at Bridge Piers and Abutments –

Bridge failures in other states prompted a look at rock scour conditions around bridge foundations on Kentucky. Findings showed that scour of rock around footers is not a major problem in Kentucky.



Resilient Modulus of Soils – Future pavement design models slated for use by the year 2002 will require new types of soil parameters. Testing of Kentucky soils using the equipment shown at right provides an important step toward readying Kentucky for use of the new pavement design procedures.



Geotechnical Research in the New Millennium

At the start of the new millennium, potential geotechnical research will likely focus on such things as finding better ways of defining the shear strengths of soils and rocks; new mathematical models that accurately predict the short-term and long-term behaviors and stabilities of geotechnical structures resting on and in soils and rocks; improving compaction equipment and methods to reduce the cost of constructing, or reconstructing, new highway embankments; And finding new and innovative ways of improving soils and rocks of

low strength. A broader use of synthetic materials and ultra-lightweight materials will become prevalent. New techniques for preventing and repairing landslides and rock falls and improving highway design standards will evolve. Development of a statewide soil and rock engineering database in a client/server ("windows") environment will be extremely valuable for planning new and reconstructed highways and in the economic development of Kentucky. By using the internet, these data will be accessible worldwide.

Intelligent Transportation Systems

Intelligent Transportation Systems, or ITS, refers to any application of advanced technology for the purpose of improving surface transportation. The types of technologies most frequently applied to ITS include detection, processing, and communications. These technologies are used to improve transportation by making it safer, more efficient, and more environmentally “friendly.”

The Commonwealth of Kentucky and the Kentucky Transportation Center have enjoyed a position of national prominence in ITS throughout the decade of the 1990s. Beginning with substantial roles in major Commercial Vehicle Operations (CVO) projects, this prominence is now spreading into other areas of ITS.



Advantage CVO — Roadside AVI readers “communicate” with trucks in the Advantage CVO program.



Remote Monitoring System — This commercial vehicle is using US 25 and avoiding the nearby weigh station.

Current ITS Projects

Advantage CVO

Kentucky is the lead state in this public/private partnership which promises to reduce congestion and improve safety at weigh/inspection stations. Transponder-equipped commercial vehicles are monitored along the I-75 corridor and Canadian Highway 401 using weigh-in-motion scales and automatic vehicle identification (AVI) readers. Qualified commercial vehicles may travel the entire corridor without a single stop at any of the 27 participating weigh stations. The University of Kentucky Transportation Center provided program administration and technical support for the Advantage CVO Partnership.

ITS Strategic Plan and Architecture

KTC is currently preparing Kentucky's ITS Strategic Plan and Architecture in the areas of traveler information, traffic management, commercial vehicles, public transit, rural transportation, and vehicle control systems. As part of this effort, the Center has assessed available technologies, user needs, and Kentucky's existing infrastructure. The Plan will serve as the foundation and frame-

work for the implementation of ITS technologies in the state of Kentucky.

MACS Software Development

The Transportation Center is managing a contract with TRW to develop new weigh station computer software for the Mainline Automated Clearance System (MACS), which performs electronic screening of commercial vehicles. The new software is based on a system design and functional requirements developed by the Center, and will be made available to other states wishing to deploy electronic screening systems.

I-65 Electronic Screening

Kentucky, in partnership with Indiana, will start a simplified electronic screening system for commercial vehicles traveling along I-65. This new system will consider prior weight compliance in the screening of trucks, eliminating the need for mainline weigh-in-motion. Due to its low implementation cost, simple design, and compatibility with other systems, it is being promoted as the model for electronic screening in other states. The Transportation Center will provide the

technical support necessary for development and deployment of this simplified electronic screening system on I-65.

Remote Monitoring System

KTC serves as project manager and evaluator for the Remote Monitoring System. This image capture system will allow commercial vehicle enforcement officers to monitor truck traffic on US 25 while at the southbound Kenton County weigh station on I-75. When a potential problem is identified, officers will be dispatched to intercept the vehicle.

Roadside Identification Feasibility Study

Under contract with the Federal Highway Administration (FHWA), KTC identified and evaluated various technologies for identifying motor carriers and commercial vehicles at the roadside for slow- and high-speed electronic screening purposes. Also as part of this effort, the Center assessed the needs of the States and the Office of Motor Carrier and Highway Safety (OMCHS) and made recommendations for further testing and implementation of the most promising technologies.

Cumberland Gap Tunnel ITS Applications

This \$26-million project located in the Cumberland Gap National Historical Park relies on ITS technology for travelers' safe passage through the Tunnel. Closed-circuit cameras located throughout the 4,600-foot twin tunnels constantly monitor traffic, while changeable message signs are used to communicate with drivers.

Additional funding was provided for the Cumberland Gap project through the ITS Deployment Program. The Transportation Center, in concert with the Kentucky Transportation Cabinet, will plan deployment and integration of additional ITS technologies and systems to enhance the safety, mobility, and operations of the regional transportation system in the Cumberland Gap area.

CVISN Model Deployment

As a Model Deployment State for Commercial Vehicle Information Systems and Networks (CVISN), Kentucky is one of the first states in the United States deploying an integrated suite of user services designed to improve the efficiency and effectiveness of commercial vehicle administration and enforcement programs. The Transportation Center is providing technical and program management support to the Kentucky Transportation Cabinet for this program.

User Survey for ARTIMIS Telephone System

In the spring of 1999, a research project to survey users of the ARTIMIS Travel Advisory Telephone Service in Greater Cincinnati/Northern Kentucky was initiated to evaluate the influence of the service on travel behavior as well as the preference for different dialing codes. The first report from this project has been submitted by the state of Kentucky as part of its submission to the Federal Public Service Commission for the FHWA's bid for a 3-digit number, such as 211, for nation-wide travel information.

Roadside Identification Feasibility Study — Without automated systems for identification, officers must stop vehicles and check their credentials.



CVISN Model Deployment — The brakes on this commercial vehicle are being evaluated using a roller-brake system.

ITS in the New Millennium

Within the first two decades of the new millennium, surface transportation will undergo revolutionary changes. Advances in traveler information systems will provide rural and urban travelers with unprecedented access to real-time information on available modes, travel times, best routes, and available services. Advanced traffic management systems will maximize the effective use of available facilities and minimize the impact of incidents. Public transportation will become increasingly attractive due to improvements in efficiency, security, and up-to-date information for users. Commercial vehicle administration and enforcement will be accomplished seamlessly and effectively, with minimal disruption of

safe and legal operations. Finally, in the first steps toward a fully automated highway system, on-vehicle technologies will be deployed to assist in the driving task. Initial deployments will include adaptive cruise control, collision warning, lane departure warning, and advanced braking systems.

To achieve the benefits possible through ITS, the many available technologies must be deployed in an integrated fashion so that the various pieces work together. In addition, opportunities for innovation must be recognized and seized. Rather than simply automating existing processes, transportation professionals should examine those processes to determine where fundamental changes may be appropriate.

Structures

The research activities conducted in the Structures section focus primarily on highway bridges and on fiber reinforced polymer (FRP) composites for infrastructure applications. The research deals with seismic evaluation of bridges, bridges susceptible to barge and truck impact, effectiveness of intermediate diaphragms in P/C I-girder bridges, full-depth bridge slab overlay, FRP bridge decks, FRP reinforced and prestressed concrete structures, strengthening of existing structures with FRP components, and testing of advanced FRP components. The section has a lab with a strong floor system, and a loading frame that is capable of testing two-span structural specimens. Implementation of the section's research finding leads to safer bridges and to highly cost-effective investments of the public funds.

Structures Research in Progress

Seismic Evaluation of the I-24 Corridor for Moderate Seismic Events

Bridges on or over the I-24 corridor will be evaluated for projected seismic events. If needed, retrofit measures will be proposed to enhance the capability of the bridges to survive an earthquake, and to remain open to traffic.

Barge Impact Loads on Bridge Piers

Laboratory testing is being conducted to determine impact loads on bridge piers resulting from barges of various sizes and impact speeds. The outcome of this research will lead to more accurate load prediction on bridges over Kentucky's navigable waterways.

Structural Evaluation of the Roebling Bridge

This study will assess the response of the bridge to current and projected traffic loads. The study involves field testing and modeling of the bridge in order to generate "signatures" which will be the basis for future evaluations and ret-

rofits, and will assist in the preservation of the Roebling Bridge, which is regarded by many as a "National Treasure." The bridge is located in Covington, Kentucky, overstretching the Ohio River.

Full-Depth Bridge Slab Overlay

This study is evaluating the structural effects of full-depth slab overlays on Kentucky's bridges and their viability as a method of rehabilitation for other bridges. Full-depth slab overlays reduce overall project costs, and enable bridge load capacities to be increased without need of expensive slab and girder replacement.

Bridges Susceptible to Vessel and Truck Impact

This study is developing risk assessment models in order to determine the probability and the associated dynamic impact energies of vessel and truck impact with bridges. This will lead to rational and more realistic design guidelines and methodologies for bridges susceptible to vessel and truck impact.



Fiber Reinforced Polymer (FRP) Bridge Deck Systems

Various FRP bridge decks were tested in the laboratory and compared with standard steel reinforced concrete (R/C) panels. The FRP panels surpassed the R/C panels in load capacity and deflection limitations. The advantage of the FRP panels lies in the

rapid replacement of bridge decks, and in longer service life.

Reinforcement Alternatives for Concrete Bridge Decks

Laboratory evaluation of bridge deck panels without top mat reinforcement and panels with top mat carbon FRP rebars. Field deployment

will be carried out following testing. This approach will eliminate bridge deck degradation resulting from corrosion of top steel mat.

Carbon FRP for Repair and Strengthening of Bridges

FRP carbon cloth and strips are used to increase/strengthen the shear and for flexural capacities of reinforced concrete beams/girders. The main advantage of this technique is upgrading and prolonging the life of in-service bridges.

Monitoring of a Bridge Deck Partially Reinforced With FRP Rebars

The Roger's Creek bridge in Bourbon County, Ky., has glass FRP rebars in a portion of the top mat. Field monitoring is being conducted on a monthly basis for a period of three years to determine crack formation, crack width and

length over a period of time. This study will provide a one-to-one comparison between the FRP and steel reinforced portions of the bridge deck.

Bridge With Concrete I-Beams Prestressed With CFRP Tendon

Carbon FRP prestressing tendons will be deployed, fol-

lowing laboratory testing, in a bridge in Kentucky. The use of this high performance material will prolong the service life of bridges.

Non-Magnetic Platform

This project deals with the use of advanced composite materials in an equipment platform for acoustic testing

at the Coastal Systems Station of the Naval Surface Warfare Center in Panama City, Florida. This project illustrates the value of research by transferring aerospace technology to infrastructure applications leading to an economical solution to a complex construction project.



Recently Completed Structures Research

Seismic Rating and Evaluation of Highway Structures

In this study, dynamic site periods due to seismic loading were generated for the Jackson Purchase area in western Kentucky, and seismic evaluation of the US 51 and US 41 bridges was conducted along with stability assessments of highway bridge approach embankments and retaining structures.

Bridges With and Without Diaphragm

This study evaluated the effectiveness of concrete intermediate diaphragms in prestressed I-girder bridges. The experimental and analytical studies showed that interme-

diate diaphragms are not needed, and that they could be replaced with temporary steel Z-bracing during construction and deck replacement.

High-Performance Composite Material Structures

Testing, design and construction of the Clear Creek Bridge, which is the longest FRP girder bridge in the world, were conducted in this study. This 60-foot pedestrian bridge is made of light weight composite materials and is located in the Daniel Boone National Forest in Bath County. In addition, the construction of a composite deck on the 420-ft long suspension bridge in Johnson County in

1999, makes the longest bridge deck in the world.

FRP Reinforcing Bars in Bridge Decks

Laboratory testing was conducted on bridge deck

panels reinforced with steel and/or glass FRP rebars to generate design guidelines. The GFRP rebars were later deployed in the Roger's Creek Bridge in Bourbon County.

Structures Research in the New Millennium

Since the turn of the twentieth century, research has always played a vital role in advancing our transportation system. The value of research has manifested itself in safer modes of transportation and highly cost-effective investments of the public funds. Research in the Structures area in the new millennium will focus on the evaluation and deployment of advanced fiber reinforced polymer (FRP) composites. FRP components will be one of the construction materials in the twenty-first century. Furthermore, research in the areas of seismic evaluation and vessel and truck impact studies will lead to safer bridges in the Commonwealth and the nation.

Traffic and Safety

Research Areas

The Traffic and Safety section has traditionally focused on research and training in a wide range of areas, including the following:

- Evaluation of highway safety features
- Accident analysis and investigation
- Traffic forecasting
- Highway cost allocation
- Analysis of traffic control devices and operational features
- Evaluation of roadway delineation devices and materials
- Review and analysis of incident management procedures
- Transportation safety management evaluation
- Evaluation of advanced technology applications to transportation

Workshops and Seminars

Research is the primary function of the Traffic and Safety section; however, staff has developed expertise and served as instructors in the following workshops and seminars:

- Safety features for local roads and streets
- Work zone traffic control
- Roadway signs and markings
- Tourist signing
- Traffic accident investigation
- Coal truck driver safety training
- Roadway incident emergency response
- Tort liability and risk management

Accomplishments and Milestones

- Completion of a final report on analysis of heavy truck accidents
- Completion of a final report on road weather information systems
- Completion of a final report on Kentucky's driver licence system
- Completion of reports for the Kentucky State Police on accident rates and safety belts
- Completion of an interim report on roadway reference markers
- Prepared proposal to assist in securing funding for the Cumberland Gap Tunnel
- Initiated work and developed preliminary data for graduated driver licensing
- Initiated development of a workshop on "Flexibility in Design of Highway"

Heavy Truck Accidents and Countermeasures

The primary objectives addressed were identification of issues related to heavy truck accidents and recommend countermeasures related to the driver, roadway, and the vehicle. It was determined that accidents involving heavy trucks were typically more severe and represent higher percentages of fatal accidents than collisions involving other types of vehicles. Special roadway problem locations were interchange ramps, steep grades, sharp curves on two-lane roads, and intersections. Vehicle areas with the greatest potential for improvement were rear underride protection, lighting and reflectivity, and improved braking capabilities. Drivers' issues were primarily safety training and education.

Road Weather Information Systems

Road Weather Information Systems were found to be a valuable tool to assist those responsible for managing the adverse effects of winter weather. Presently there are six weather stations in Kentucky which have been strategically located to provide the maximum benefit for use of the following information collected from sensors: air and pavement temperatures, precipitation, relative humidity, wind speed, surface condition, and chemical concentration. Advanced technologies for monitoring and measuring weather conditions, in conjunction with dissemination of this information, can serve to improve the overall safety of Kentucky's roadways during winter weather.

Driver Licensing

A report on recommended improvements to the driver licensing process for Kentucky was completed and the primary issue was criteria for retesting, the results which have not yet been implemented. Graduated driver licensing for teenage drivers has now been in place for two full years and the benefits are significant for 16-year old crash involvement rates.

Roadway Reference Markers

An interim evaluation has been completed of roadway reference markers installed on interstates in the areas of Northern Kentucky-Cincinnati, Louisville, and Lexington. The results indicate nearly unanimous endorsement of the reference markers from highway agency personnel and participants in the emergency management process. Recommendations were for spacing the markers at 0.2-mile intervals, use of white letters on blue background, and placement on median barrier walls.

Cumberland Gap Tunnel

A proposal was prepared for the Transportation Cabinet and funding was secured for a wide range of advanced technology applications at the Cumberland Gap Tunnel and the surrounding area. Traditional technologies included variable message signs, highway advisory radio, and road weather systems. New concepts to be implemented include a regional radio system coordination with the Tunnel control center, electronic identification and monitoring

of hazardous cargo trucks, and computerized dispatch of public transit vehicles.

Flexibility in Design of Highways

A new approach to the design of highways has begun to evolve with the focus on public involvement in the overall process and significantly greater attention given to issues related to esthetics, historical areas, cultural concerns, and the environment. These and other concepts have been built into a workshop which is under development and scheduled for presentation during the upcoming year.

Traffic and Safety in the New Millennium

The concepts of traffic and safety after the year 2000 will likely change dramatically with the diminishing role of personal transportation. It has already been demonstrated that technologies can now be applied to transportation in ways that will limit human input and maximum electronic guidance systems. Transport modes and transportation passageways will be designed with environmental and safety issues paramount. The limited supply of natural resources, the encroachment into environmental limits, and the medical costs associated with vehicular crashes will force new concepts of transportation. Time used to travel these new passageways and distances traveled will be measured and allocated. Travel will be safer, the opportunities for unlimited travel will be less, and the cost to travel will be more.

PAVEMENTS

The Pavement Section conducts research on paving materials and the multiple factors that may affect the short-and-long term performance of these pavements. These factors include construction, weather, subgrade, drainage, and heavy loads. The pavement section, along with the Transportation Cabinet, is not just concentrating on building longer lasting roads but are also evaluating delay times, increasing the contractor's responsibility

Pavement Research in Progress

High Performance Intersection

Intersections are prone to early failure due to heavy loads being concentrated on the pavement at stop signs and traffic signals. The Center is working with the Cabinet, contractors, and other agencies to reduce early failure rates at intersections. Research is currently being conducted on high performance asphalt and concrete inlays to determine the best performance for the tax dollar.



Instrumentation and Evaluation of Loading and Environmental Effects on Concrete Pavements



Historically concrete pavements initially start to fail at the joint between slabs. In July of 1999, the Pavement Section installed more than 50 instruments in three concrete slabs on I-265. A large percentage of the instrumentation is concentrated around the joints of the slabs. The instruments will measure pressures at the joints, subgrade, and will record slab warping due to environmental changes. The information gathered will provide valuable information on the reaction of the slab and will permit engineers to design longer lasting concrete pavements.

Pavements Research in the New Millennium

Starting the later part of 1999, and continuing into the new millennium, pavement research will be focusing in great depth into reducing water infiltration into the pavement and removing infiltrated water from the pavement. Research will include the evaluation of drainage systems for rehabilitated and resurfaced pavements, compaction at construction joints in asphalt pavements, and the development of a field permeability test for asphalt concrete and aggregate bases. The new millennium will also place more emphasis on evaluating users costs. New research will include developing resurfacing warrants and guidelines for pavement rehabilitation, and evaluating road user costs for construction contracts.



ity for the end product, and reducing the length of construction projects through innovative bidding and construction bonuses for early completion.

Evaluation of SUPERPAVE

SUPERPAVE, a new asphalt mix design procedure, was introduced in the early 90's. In 1995, the Kentucky Transportation



Cabinet constructed its first SUPERPAVE pavement. Since 1995, more than 50 sites have been constructed in Kentucky. For the last two years the Pavement Section has been evaluating the performance of the previous Marshall mix design method and comparing it to the SUPERPAVE method. Although the SUPERPAVE pavements are still relatively young, it appears that they will outperform conventional mixes.

Advanced Technology

The pavement section is utilizing advanced technology to evaluate pavement construction and performance. Highly sensitive infrared scanners are being utilized to evaluate thermal differences in asphalt pavements during construction. Since it is critical that the mix is hot during compaction, any significant thermal difference could impact pavement performance. The Kentucky Transportation Cabinet has specified the use of material transfer devices on Interstates and Parkways in order to reduce aggregate segregation. Recent research indicates that the transfer devices also reduce the amount of thermal segregation.

Planning & Technology Solutions

Though loosely formed for some time, the Planning and Technology Solutions Team is officially the newest section within the Kentucky Transportation Center. This group's diverse projects and assignments are a direct result of market demands. As the needs of the transportation community continue to evolve, so does our effort to meet these needs. Accordingly, many of the projects in this section are considered to be "cutting edge" with a concern for how things are to be done in the future rather than in the past. Here are some of the projects in progress:

CVISN

Kentucky is one of eight Model Deployment states for Commercial Vehicle Information Systems and Networks (CVISN), a nationwide effort funded by the Federal Highway Administration, Office of Motor Carriers. CVISN can best be described as the national architecture for ITS/CVO systems and services. This initiative is a very comprehensive effort, covering everything from how a trucker applies for his credentials to electronic clearance of trucks at weigh stations.

The Center provides overall management support, case study evaluations, information/media materials, and technical advice and support to the Kentucky Transportation Cabinet in this effort.

The end result, when the CVISN architecture is implemented, will be more effective and efficient commercial vehicle operations, *in addition to safer highways.*

MAINSTREAMING

The ITS/CVO Mainstreaming Program was implemented to promote nationwide deployment of ITS/CVO technologies. Kentucky is playing a major role in this deployment effort by serving as Regional Champion for two regions, the

Great Lakes and Southeast. These regions are comprised of the states of Georgia, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, Indiana, Michigan, Minnesota, Wisconsin, Ohio and West Virginia.

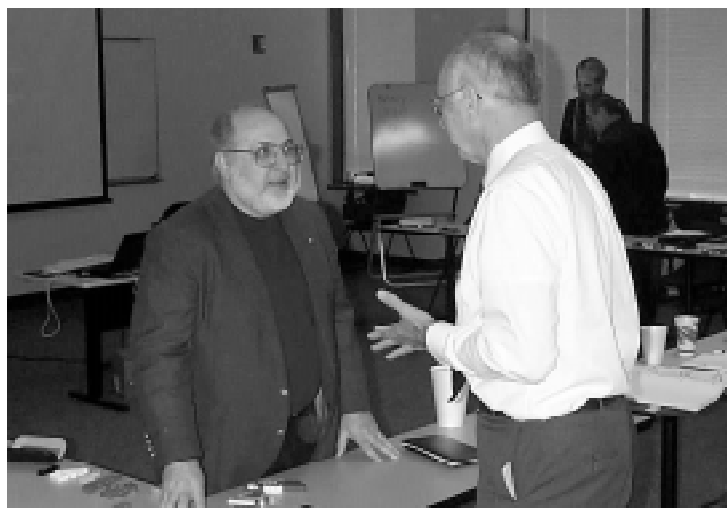
The Center is taking the lead in providing planning, guidance, and outreach to these states through semi-annual forums, case study documentation and development and maintenance of a program website.

Mainstreaming was expanded by FHWA/OMC to include the delivery of three ITS/CVO courses. Four section members were selected to serve on one of six national training teams to accomplish this task.

TECHNICAL ASSISTANCE

Route Planning

The Kentucky Transportation Cabinet has asked the Kentucky Transportation Center to develop a new route planning process utilizing the unique data-handling and analysis capabilities of Geographic Information Systems. Environmental, socioeconomic, engineering, and economic development considerations are all part of the equation. UKTC has gathered and converted more than fifty



Don Hartman fields a question during an ITS/CVO training course delivery.

kinds of information relevant to highway route planning, and is developing tools to aid planners and designers in better evaluating alternative routes across the complex economic and environmental landscape of Kentucky.

Intermodal Management System

An extensive GIS database of intermodal facilities, and a dedicated advisory panel of industry experts form the backbone of Kentucky's Intermodal Management System. As part of the Kentucky Transportation Cabinet's commitment to greater public involvement, the UKTC staff introduced group-based prioritization techniques to aid in selecting intermodal highway projects. These techniques have been used successfully by UKTC staff in

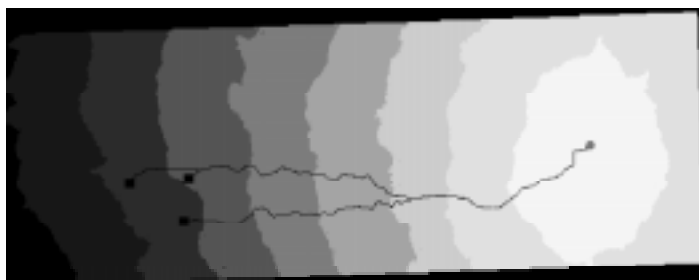
past World Bank projects and show promise for the Commonwealth.

GIS Coverage

To assist KYTC in maintaining and upgrading their extensive highway GIS coverage, UKTC provides close and ongoing technical assistance. Issues of design and maintenance, along with regular support of data input and map production all fall within the purview of the assistance.

Transportation Systems Management Graduate Certificate Program

UKTC supports a graduate certificate program in Transportation Systems Management at the University of Kentucky. This interdisciplinary program involves students from Civil Engineering,



Example of a GIS travel cost surface map.

Geography, Public Administration, and Business, and has been in place for eight years. The program involves experiential learning along with classes and projects designed to introduce students to the issues of transportation systems. Both fellowship and non-fellowship students participate in the program. In 1998-99, twelve students completed the certificate program. Past students from this program are now involved in transportation issues ranging all the way from design to management to research. This is the center's experiential education program.

Benefits of Kentucky Community Transportation

Despite being a comparatively rural state, Kentucky has an extensive and vital system of public transportation, both

urban and rural. UKTC undertook a study of the benefits that accrue to the Commonwealth from the operation of these systems across the state. Besides contributing nearly \$60 million annually to the Kentucky economy, public trans-

portation carries nearly half a million Kentuckians every week. With the advent of a new statewide management system for public transportation, the potential for greatly increased usage is becoming a reality in Kentucky.

Planning & Technology Solutions Team In The New Millennium

As the general public becomes better educated and informed, they will expect to have a greater voice in the implementation of technologies and the expenditure of their transportation tax dollars. Transportation professionals will not only need to understand the potential uses of new technologies, but how to involve their future users in the participatory design of those technologies. Decision making about public investment will likewise require that transportation users be "built into" the process of choosing and building new infrastructure. All this points to the evolution of the transportation system as a technical-social system demanding many kinds of skill and disciplines from the professional community to support it.

Construction Related Research Projects

Members of the Construction Engineering and Management Area of the Civil Engineering Department are currently conducting six construction-related research projects through the KTC for the Kentucky Transportation Cabinet. A project to develop a conceptual cost-estimating model for use in setting the initial cost budget for new cabinet projects when initiated in the Six Year Plan is being completed. A computer model has been developed for District personnel based on historical cost records of past cabinet construction projects. Final efforts are underway to help the Cabinet implement the established database system.

Research continues to evaluate the innovative contracting methods being used on the Paris Pike Reconstruction Project from Lexington to Paris, Kentucky. The study will measure the final results achieved on the project and

compare them to results typically attained on cabinet construction projects performed under the traditional design-bid-build method. This project is one of the most unique highway construction projects ever built in Kentucky.

A major challenge to the Cabinet is the estimate of contract time for its construction projects. A computer model called the KY-CTDS, Kentucky Contract Time Determination System, has been developed. Efforts are now underway to develop a training program and a final users manual for the computer system. Training sessions will be held for district personnel this year. Applications of the conceptual scheduling system for the planning and design phases of a cabinet construction project will also be investigated as time permits.

Several teams have been established with cabinet per-

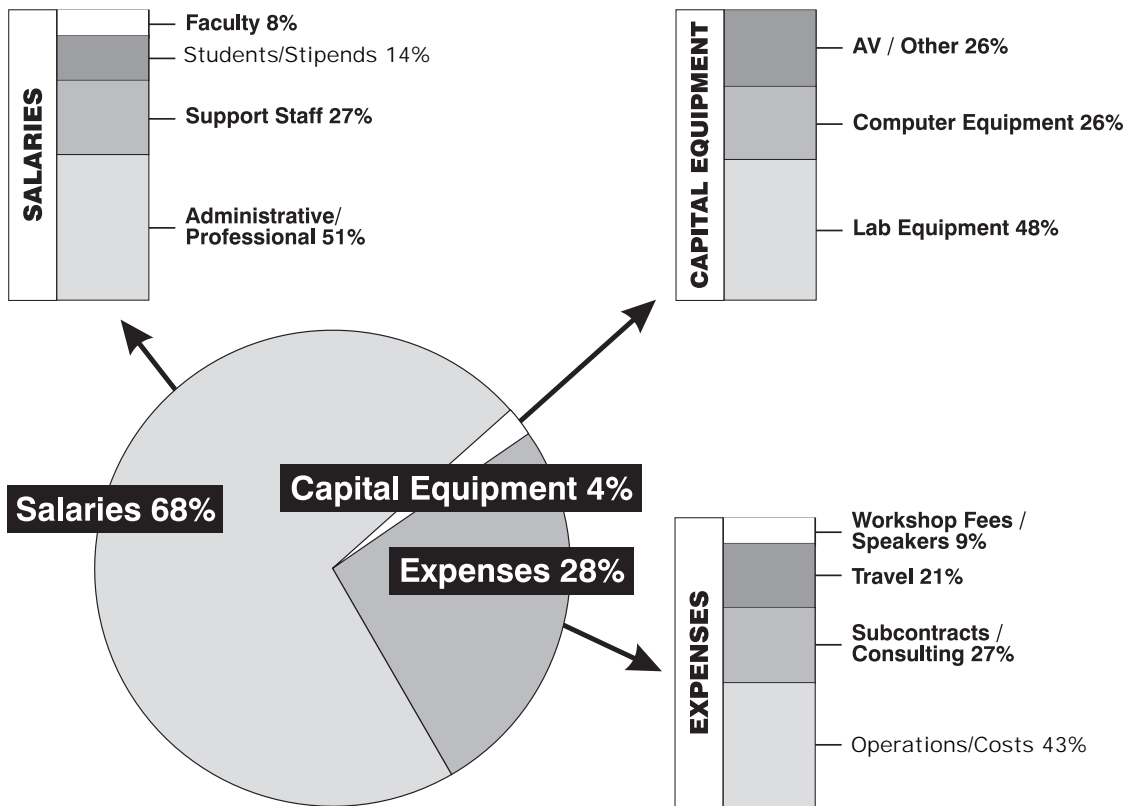
sonnel, UK personnel and industry members. The teams goal is to incorporate quality into cabinet construction projects by transitioning from method specifications to QC/QA, performance related, warranty, and other innovative specifications that allow contractors the freedom to utilize their expertise and that promote efficient use of Department personnel. Several improvements in the current specifications have been identified and pilot projects have been initiated to evaluate several other proposed improvements. The teams continue to meet this year to identify further opportunities for improvement.

Two new projects have been initiated this year. One project will review the results of utilizing nighttime construction on past cabinet and other state department of transportation construction projects. Efforts will also be

undertaken to identify the potential advantages and disadvantages of utilizing nighttime construction, to recommend the feasibility of using nighttime construction practices for cabinet projects, including the primary project characteristics required for successful implementation. A second project will identify the primary elements of contractor work performance that indicate the quality of the work achieved. A quality performance rating system will be developed for contractors' performance on cabinet construction projects. Finally, a method will be developed for utilizing the contractor quality performance rating system in the transportation cabinet prequalification process and other applications.

More details on any of these research efforts can be obtained from Drs. Donn Hancher, Jim Stevens or Bill Maloney of the Civil Engineering Department and construction research engineers for the Kentucky Transportation Center.

1998-99 Expenditures



	TECHNOLOGY TRANSFER	RESEARCH	EXPERIENTIAL EDUCATION	STATE ADMINISTRATION	TOTAL PROGRAM
SALARIES					
Admin/Professional	\$191,013	\$1,346,422	\$0	\$62,665	\$1,600,100
Faculty	5,472	246,737	0	0	252,209
Support Staff	96,960	742,858	0	6,072	845,890
Students/Stipends	6,955	379,495	75,250	287	461,987
TOTAL SALARIES	\$300,400	\$2,715,512	\$75,250	\$69,024	\$3,160,186
EXPENSES					
Wkshop Fees/Speakers	\$111,803	\$0	\$0	\$0	\$111,803
Sub-contracts/Consulting	22,060	314,207	0	8,856	345,123
Operation Costs	193,261	336,766	156	23,977	554,160
Signs for Locals	0	0	0	0	0
Travel	40,117	220,069	7,039	7,375	274,600
TOTAL EXPENSES	\$367,241	\$871,042	\$7,195	\$40,208	\$1,285,686
CAPITAL EQUIPMENT					
Computer Equipment	\$0	\$46,334	\$0	\$0	\$46,334
Lab Equipment	0	83,367	0	0	83,367
AV/Other	0	45,246	0	0	45,246
TOTAL EQUIPMENT	\$0	\$174,947	\$0	\$0	\$174,947
TOTAL DIRECT COSTS	\$667,641	\$3,761,501	\$82,445	\$109,232	\$4,620,819
INDIRECT COSTS	\$8,268	\$816,874	\$1,655	\$0	\$826,797
TOTAL PROGRAM EXPENDITURES	\$675,909	\$4,578,375	\$84,100	\$109,232	\$5,447,616

Note: The university contributes approximately 30% indirect cost to the Technology Transfer LTAP program.

Research Reports

- KTC-98-12 "Experimental Analysis and Analytical Modeling of Bridges With and Without Diaphragms," James J. Griffin, Issam E. Harik, and David L. Allen, July 1998.
- KTC-98-13 "Field Performance Report on 48 inch, HDPE on US 127, Owen County," L. John Fleckenstein and David L. Allen, July 1998.
- KTC-98-14 "A Methodology for Evaluating Large Truck Access to Intermodal and Other Facilities," Lisa Altman-Hall, Michael L. Hill and Kenneth R. Agent, July 1998.
- KTC-98-15 "1998 Safety Belt Usage Survey and Evaluation of Effectiveness in Kentucky," Kenneth R. Agent, September 1998.
- KTC-98-16 "Analysis of Traffic Accident Data in Kentucky (1993-1997)," Kenneth R. Agent and Jerry G. Pigman, September 1998.
- KTC-98-17 "Registration Violations and the Use of License Plate Recognition systems at Kentucky Weigh Stations," Jennifer R. Walton and Joseph Crabtree, September 1998.
- KTC-98-18 "Cost Estimating and Forecasting for Highway Work in Kentucky," James D. Stevens, September 1998. (SPR 94-158)
- KTC-98-19 "Annual Assessment of Customer Needs and Satisfaction," Patsy Anderson and Kris Koehler, October 1998.
- KTC-98-20 "Seismic Evaluation of the Ohio River Bridge on US51 at Wickliffe, Kentucky," I. E. Harik, C. M. Madasamy, D. Chen L. Zhou, K. Sutterer, R. Street and David Allen, November 1998.
- KTC-98-21 "Analysis of Vehicle Classification Data, Including Monthly and Seasonal ADT Factors, Hourly Distribution Factors, and Lane Distribution Factors," David L. Allen, Nikiforos Stamatiadis and R. Clark Graves, November 1998.
- KTC-98-22 "Evaluation of 93- inch corrugated Metal Culvert on Ky 693 and US23, Green-up County," L. John Fleckenstein, Richard Reitenour and David L. Allen, November 1998.
- KTC-98-23 "Evaluation of Reference Signs," Jerry Pigman, December 1998.
- KTC-98-24 "Probabilistic Lifecycle Cost Analysis FHWA Demonstration Project DP115," Clark Graves and David L. Allen, December 1998.
- KTC-99-1 "Development of ESAL Forecasting Procedures for Superpave Pavement Design," Brad Rister, and David L. Allen, February 1999. (SPR 99-194)
- KTC-99-2 "Development of an Information Management System for Assisting Kentucky Transportation Cabinet Personnel Concerning Environmental Issues," Bobby Meade, Sudhir Palle, Theodore Hopwood, II, March 1999. (SPR 96-168)
- KTC-99-3 "Employee Satisfaction Survey," Patsy Anderson, Dr. Bennett Tepper, March 1999. (SPR 99-203)
- KTC-99-4 "An Investigation of the Deterioration of I-75 in Scott County," Allen Meyers, David Allen, and L. John Fleckenstein, March 1999.
- KTC-99-5 "Evaluation of Corrugated Steel Pipe Culverts Ky 55, Shelby County," L. John Fleckenstein and David L. Allen, March 1999.
- KTC-99-6 "Pavement Design Guide, A Short Course," Clark Graves & David Allen, March 1999.
- KTC-99-16 "Seismic Evaluation of the US 41 NORTHBOUND Bridge over the Ohio River at Henderson, Ky," Issam E. Harik, April, 1999.
- KTC-99-17 "Seismic Evaluation of the US 41 SOUTHBOUND Bridge over the Ohio River at Henderson, Ky," Issam E. Harik, April 1999.
- KTC-99-20 "Heavy Truck Involvement in Traffic Accidents," Jerry G. Pigman and Kenneth R. Agent, March 1999. (SPR 98-181)
- KTC-99-21 "Evaluation of Road Weather Information System," Joel M. Weber, R. Clark Graves, and Jerry G. Pigman, April 1999.
- KTC-99-22 "Laboratory Testing and Analysis of Joints for Rigid Pavements," Issam E. Harik, Chelliah Madasamy, David L. Allen, and L. John Fleckenstein, June 1999.
- KTC-99-23 "Evaluation of Kentucky's Driver License Renewal Process," Nick Stamatiadis, Kenneth R. Agent, and Jerry G. Pigman, June 1999. (SPR 98-184)
- KTC-99-24 "ARTIMIS Telephone Travel Information Service: Current Use Patterns and User Satisfaction," Lisa Aultman-Hall, Sarah bowling, and Jill Clemens, June 1999.
- KTC-99-31 "A Report on County Road Program Finance," Fiscal Year 1997-1998, Patsy Anderson, and Kris Koehler, June 1999.
- KTC-99-48 Final Summary Report on "Truck Route Access Evaluation," Freight Movement & Intermodal Access in Kentucky, Lisa Aultman-Hall, May 1999. (SPR 98-189) Note: A series of 48 truck route access evaluations were completed for specific sites and issued as interim reports.
- KTC-99-49 "Evaluation of Trimarc Procurement Procedures," Federal Aid Research Task #93, Jerry G. Pigman and Monica L. Osborne, June 1999.

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